GUIDE FOR ENVIRONMENTAL ASSESSMENT

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

Foreword

This guide was prepared as part of an overall SCS effort to refine and systematize the assessment part of planning. The material presented here is a generalized guide for conducting environmental assessment. An introduction to selected analytical assessment techniques is also included. Evaluation criteria, detailed procedures, and technical standards were intentionally omitted. SCS technical specialists establish these items for regional and local geographic areas in keeping with national standards for each technical field.

This guide represents the combined thinking of many individuals and groups within SCS. The guide was developed under the leadership of Gerald R. Lowry of the Environmental Services Division, Washington, D.C. Parts of the material were adapted from Environmental Assessment Procedure, SCS, USDA, Washington, D.C., May 1974. Comments by James Cooley, Frank Busby, and other persons at the University of Georgia and Utah State University were helpful in organizing the contents. R. C. Solomon, U.S. Corps of Engineers, Vicksburg, Mississippi, provided comments. SCS technical personnel at the Washington office, the four TSC's, and state offices provided much useful review and comment towards refining the guide.

March 1977

SCS GUIDE FOR ENVIRONMENTAL ASSESSMENT

SCS GUIDE FOR ENVIRONMENTAL ASSESSMENT

I. INTRODUCTION

This publication is a general guide for environmental assessment for Soil Conservation Service personnel to use in resource planning. Detailed procedures for assessment within each technical field are provided by specialists at Washington, TSC, and state office levels.

Environmental assessments and impact statements (EIS's) have become a central part of resource planning and an important basis from which an organization's technical capabilities and resource ethics are viewed. EIS's reflect the assessments on which they are based. Accordingly, it is imperative that we maintain high standards for conducting environmental assessments and selecting and training personnel who do this work.

A. The National Environmental Policy Act (NEPA) of 1969 requires all agencies of the federal government to:
   1. Use a systematic interdisciplinary approach in planning and decisionmaking that may have an impact on man's environment.
   2. Identify and develop methods and procedures for environmental assessment in consultation with the Council on Environmental Quality.
   3. Include with reports on proposed major federal actions significantly affecting the human environment detailed statements of environmental impact, adverse impacts that cannot be avoided, alternatives to the proposed action, relationships between short-term and long-term productivity, irreversible or irretrievable commitments of resources, and the comments of other organizations with jurisdiction by law or special expertise.
   4. Utilize ecological information in planning and developing resource-oriented projects.

   Additional information about NEPA, environmental impact statements, and environmental assessment in planning is contained in SCS Environment Memoranda and 7 CFR 650.

B. Philosophy and guidelines
   1. Environmental assessment is that integral part of planning that identifies and estimates the potential effects of alternative solutions on the environment. Assessments document existing environmental conditions and predict probable conditions for selected alternative futures. Environment is defined as the complex of circumstances, objects, and conditions that surround and significantly influence organisms, individuals, or communities. Environmental assessment recognizes the reality that our cultural system is based on, linked to, and part of nature.

The immediate purpose of assessment is to display the environmental consequences of different alternative futures to expedite decisionmaking. Such displays minimize the risk of having unanticipated consequences during plan implementation. An ultimate objective of environmental assessment is to aid the long-term optimization of resource use mandated by Section 101 of NEPA.

2. The most important characteristics of a good assessment are objectivity, reliability of data base, and accuracy of impact predictions. Environmental assessment in planning is based on the ecological principle that "everything affects everything," but it immediately recognizes that we cannot afford to consider all causes or measure all effects. In practice, it is necessary to be reasonable, use commonsense and be professional in identifying major, operationally significant properties and potential effects. Equally important, the results must be condensed into clear, objective summaries and displays to aid decisionmaking by sponsors, agency managers, and concerned publics. Readability and good illustrations are important.
3. Although environmental assessments are part of all resource planning projects, the scale, scope, and intensity should vary in proportion to the complexity of the project and the importance of the potential impacts. SCS relies primarily on interdisciplinary teams (IDT's) to determine the intensity and extent of assessment efforts.
4. Strategy for environmental assessments must be specific to the situation. There is no standard method. Persons making assessments must follow the technical literature and adapt new methods of making assessments as rapidly as better techniques become available. The material in this guide must also be adapted to individual planning programs and resources areas on a case-by-case basis. Technical specialists with training in ecology are needed as key members of assessment teams.
5. The objective of environmental assessment is to provide adequate environmental information to decision makers, not to provide all-inclusive data bases on complex environments. Adequacy means that the support file and reports contain enough environmental data for sound resource planning.
6. Environmental assessment information must be readily available to decision makers and interested public groups throughout planning. This is done by establishing a reviewable record in the form of correspondence, technical summaries, reports, and all other significant environmental data. This should be retained in the planning support file (the same support file established for other planning activities). The support file should be organized systematically for easy retrieval of data. The reviewable record of planning is needed during later stages of planning and for

postconstruction evaluations. The support file is documentation of compliance with NEPA and other environmental laws. This material also becomes part of an increasingly extensive resource planning data base for other uses.

7. An extensive body of literature is available on the subject of environmental assessment. A list of references that provides an introduction to this literature is included in Appendix A. At appropriate points in this guide, useful references are cited.
8. A schematic diagram can be used to illustrate a generic SCS environmental assessment process (figure 1). Note that the diagram is divided into three major phases: initial, detailed, and supplemental. Within each phase, individual steps or tasks are depicted separately. The same sequential pattern is reflected in the organization of this guide and provides an expanded explanation of assessment.
9. Figure 2 illustrates the general relationship of assessment to the six steps of the USDA Procedures for Planning Water and Related Land Resources. Although the material in this guide generally applies to the full spectrum of resource planning actions, it is especially suited to project planning, such as watershed projects and RC&D measures. Careful study of the RC&D and PL-566 planning handbooks, precedence diagrams, and planning flow charts will help in understanding the relation of assessment tasks to other items in planning.

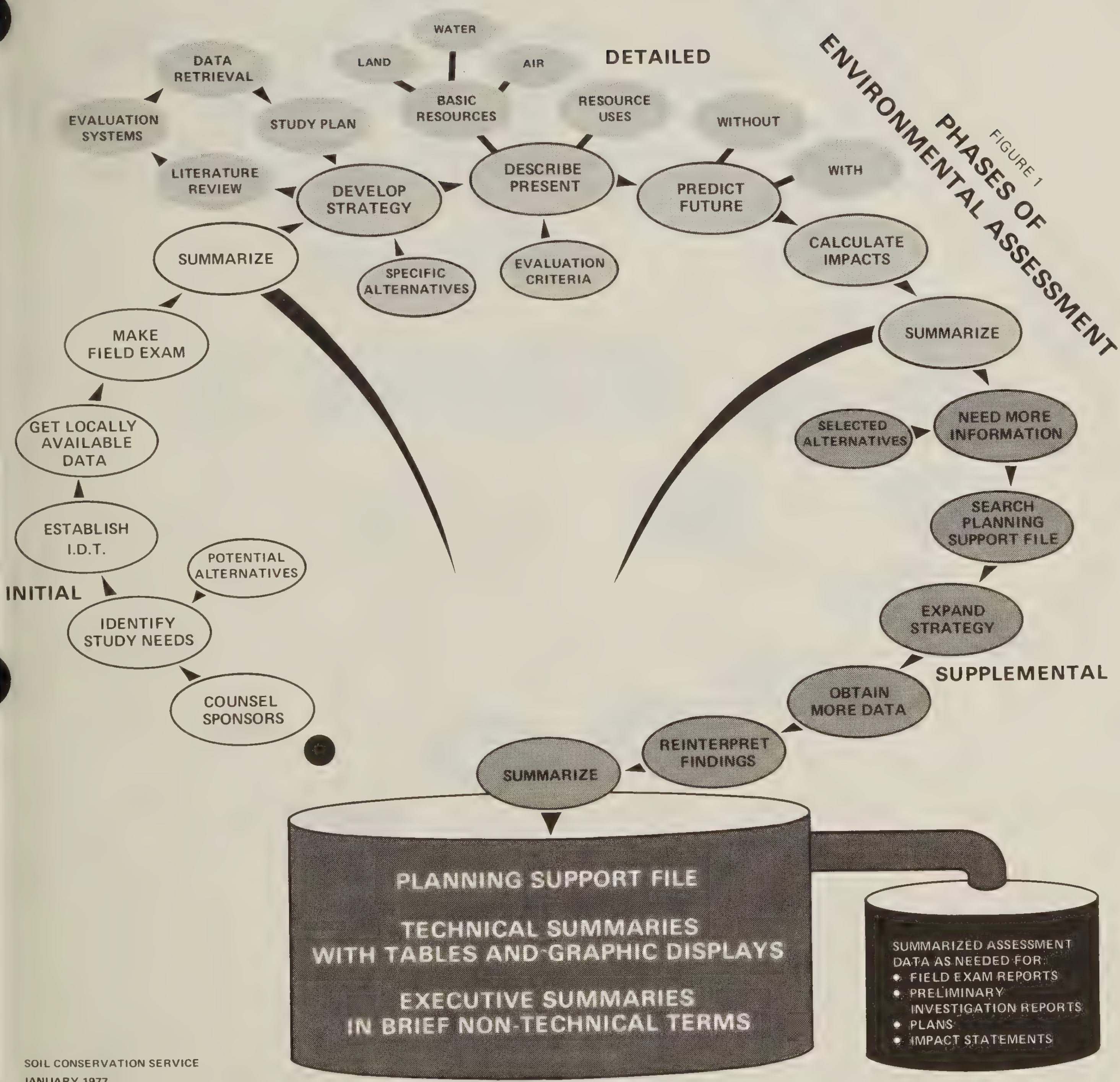
II. INITIAL PHASE OF ASSESSMENT

A. Counsel sponsors

Assessment activities should begin with environmental counseling in response to requests for assistance. Sponsors should be encouraged to think about environmental factors as they formulate and specify objectives for the proposed action. These objectives eventually are refined as part of the component needs and provide essential guidance for designing and focusing assessment. Tell sponsors about SCS planning constraints, NEPA, and other environmental considerations, especially the NEPA requirement for considering a variety of planning alternatives. Help the sponsors recognize the many public interest groups that are concerned about changes in the natural resource base.

B. Initial identification of study needs

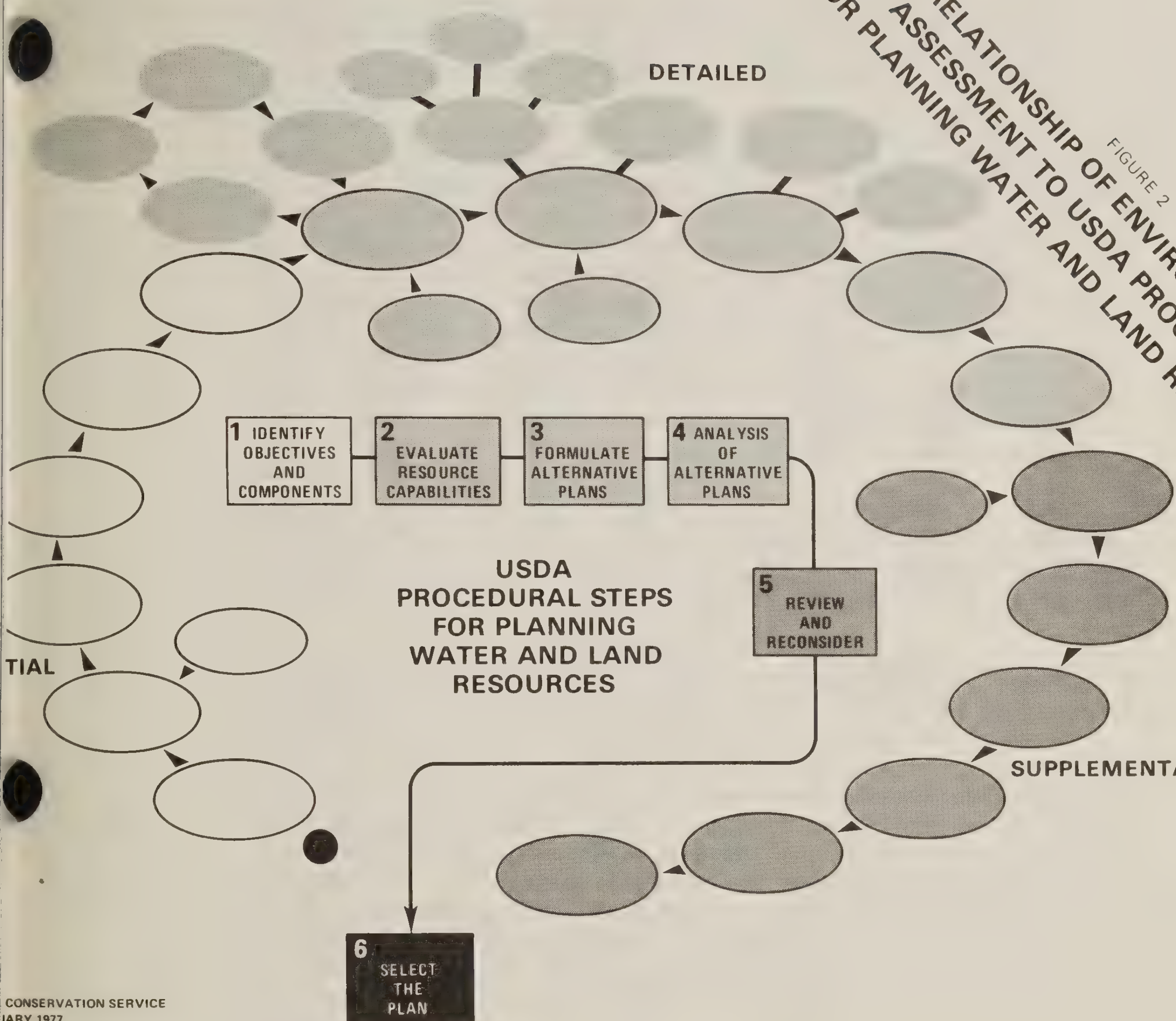
Some combination of district conservationists, RC&D coordinators, area conservationists, resource conservationists, watershed staff leaders, and sponsor representation may perform this task. Size, complexity, and diversity of resources and potential effects determine the extent of this activity. On complex planning actions (such as a watershed project), an initial assessment conference can be held to accomplish the following:



SOIL CONSERVATION SERVICE
JANUARY 1977

FIGURE 2

RELATIONSHIP OF ENVIRONMENTAL ASSESSMENT TO USDA PROCEDURES FOR PLANNING WATER AND LAND RESOURCES



CONSERVATION SERVICE
JARY 1977

1. On the basis of the original request for assistance and the sponsors' broad policy decisions, identify objectives and set broad boundaries for technical assessment that encompass the goals.
2. Identify the potential alternatives or range of alternatives likely to be considered, the probable zones of project influence (impact zones), and list the technical specialists needed. These estimates are the basis for initial assessment efforts and will be refined as planning proceeds. Identification of impact zones is important since they influence the extent and intensity of subsequent assessment efforts. These zones vary considerably according to the kind of effect being assessed.
3. Identify concerned public interest groups who should participate in or be informed about assessment activities. Do this early so that such groups actively participate and are consulted throughout assessment.
4. Identify and briefly document initial study needs as the beginning of the support file for each action. Also, include aerial photos, soil surveys and interpretations, copies of the request for assistance, and other readily available data.

C. Establish the interdisciplinary team

1. On the basis of the initial identification of study needs, assemble an interdisciplinary team (IDT). The IDT is the critical link in the assessment process. The IDT is a constantly evolving group of resource experts who interact with one another and the public to provide technical planning information to project decision makers. The task of the IDT is to provide information on present and alternative future environments as a rational basis for selecting plans. The IDT is the same group that assists sponsors with other phases of planning, including public participation. Ordinarily, the IDT consists of fewer persons during initial and supplemental assessment than are needed during the detailed phase.

   Designate an IDT leader to be responsible for managing assessment and establishing a reviewable record. The team leader is central to successful accomplishment of the assessment part of planning since he is responsible for coordinating and synthesizing team efforts. This individual may be at the field, area, or state office level of SCS, depending on the scale and scope of the action.
2. As the IDT performs its work, periodically reexamine the possible need for additional expertise. The IDT approach does not mean that all members participate in each activity, task, or stage. Members participate when their skills can have a significant effect on the assessment effort. People in other agencies and educational institutions, members of special interest groups, and consultants are sources of additional expertise.

3. It is essential that IDT members appreciate that concisely written records, displays, and data collections are the expected output of assessment activities. Written documents encourage precision, contribute to the reviewable record of planning, and support decisionmaking as a final objective.
4. Effective participation on IDT's includes keeping an open mind, avoiding prejudgment, and interchanging ideas with other participants. The reasoning behind recommendations should be clear and objective. The IDT should point out concerns, limitations, alternatives, and areas of possible tradeoff. Balance and objectivity should be preserved. Members of the IDT should discuss and plan collection of data to avoid overlap and inefficiency.
5. Make every effort to insure that IDT's have disciplinary strengths that reflect the economic, physical, biological, social, and other factors being considered. Balance in project emphasis occurs most easily when there is a balance of disciplinary influence on decisionmaking documents. Invite personnel from other concerned agencies and interested private organizations to participate as IDT members as their interests appear.

D. Obtain resource data

Examine locally available resource information such as the following:

1. Aerial photos and published maps.
2. Soil maps and interpretations.
3. Land use, cover types, water quality, and social and economic factors.

E. Make field examination

The field examination is a broad nonintensive analysis of resource factors and environmental concerns in the probable impact zones. Judgmental planning techniques are normally used. Sponsors and concerned environmental groups should participate to the extent possible in the initial assessment. RC&D and watershed handbooks provide additional guidance for field examinations to supplement the following key steps:

1. Before going to the field, brief the IDT on:
   a. Sponsors' objectives
   b. Locally available resource data
   c. Potential alternatives
   d. Analytical approaches to be used to obtain a broad overview analysis of the existing resource base and potential impacts
2. Make a visual inspection of the planning area and probable impact zones.

   Matrix analysis can be used to identify and document broad areas of environmental concern early in planning. See Appendix B for an example of a matrix. Refer to Leopold, et al.,

1971, Appendix A, for a discussion of the matrix method. Matrices usually consist of two-dimensional arrays of environmental factors versus potential alternatives and ratings of relative effect at matrix intersections. The object is to acquire broad data quickly because some studies will not proceed beyond the initial phase. Matrices are very useful visual aids for displaying preliminary environmental relationships at public meetings. Completed matrices should usually be supplemented by narratives to clarify key interactions.

In selecting potential alternatives and probable plan elements, take care to allow the unique aspects of the project area to dictate plan evolution. Always study the alternative of no project.

Experienced IDT's working on routine problems may elect not to use a matrix but proceed directly to abbreviated checklists and narrative reports. Any data collected at the field examination stage should, to the extent possible, be designed to dovetail with data collected later during more intensive phases of assessment.

3. Hold an IDT group meeting after the field examination. This meeting should feature open discussion, challenge, compromise, and consensus within and among specialists. The consensus must neither suppress nor ignore inputs of an individual specialist. Keep notes and a reviewable record of group consensus or its lack. Display facts and their sources apart from opinions and recommendations.

   Provide written summaries containing data and recommendations to the team leader as soon as possible after completion of the field assessment. This material will become the basis for an overall initial assessment summary for use in the policy formation part of planning. Record interdisciplinary dissent and technical controversy to the extent reasonable. This meeting is a good time to plan for IDT participation in presenting initial assessment data at public meetings.

F. Initial assessment summary

Prepare an initial assessment summary consisting of environmental data, assessment matrices, and generalized narratives, as appropriate and needed to fit planning needs. Enter this initial assessment summary in the planning support file along with other data and findings. For watershed projects, the initial assessment summary can probably be prepared as a part of the field examination report. For RC&D measures, it could be as simple as a brief written narrative report to the RC&D Measure Steering Committee following a technical field review.

III. DETAILED PHASE OF ASSESSMENT

This is the primary data collection and future prediction phase of assessment. It begins when project decision makers agree to advance planning beyond the initial stages and begin selecting alternatives for detailed study. When this has been done, the team leader should reconvene the IDT to develop strategy for detailed assessment. At the same time, determine the need for adding or deleting individual specialists. It is also an appropriate time to discuss further public participation.

The emphasis during the detailed phase of assessment is on developing an indepth portrait of existing conditions (quality and quantity) and estimating future conditions and impacts (direct, indirect, primary, secondary, tertiary, onsite, offsite, and other).

It is the responsibility of individual members of the IDT to specify the extent of data collection for their area of expertise. This guide is not intended to provide detailed technical procedures for assessment for each technical discipline. Such procedures are selected, developed, and disseminated in the form of various SCS technical guides and publications. Some of the detailed procedures are obtained directly from the published literature in the technical field. Each professional staff specialist is responsible for keeping abreast of the latest and best evaluation procedures in his field. Guidance and training will be provided by appropriate SCS specialists as needed.

Because of the variety and complexity of resource evaluations that SCS is concerned with, it is worth repeating that <u>environmental assessments must be tailored to each planning situation. The examples in this guide are seldom applied "as is."</u>

Following are some points to consider in making detailed assessment studies:
- Put all technical contributions in writing. Oral conclusions, no matter how useful, do not support decisionmaking.
- Edit data summaries and narrative reports of assessment primarily for technical content to expedite their completion.
- Make a special effort to present data clearly, concisely, accurately, and objectively. Environmental data are often complex, and public understanding of ecological consequences is the goal.
- To improve efficiency, concentrate assessment in areas of significant impact for the alternatives being considered.
- Hold periodic briefings to help accomplish meaningful consensus among IDT members.
- Continue data collection until the resulting assessment summaries provide a data base that reasonably addresses the probable and significant concerns in relation to each alternative being considered.
- Record data in systematic form for permanent retention in support files.

Following is a set of procedural steps that can be adapted to the planning needs of individual projects:

A. Develop a strategy for detailed assessment

1. Review the literature

   The first step in developing a detailed assessment strategy is to obtain and review literature and other planning information pertinent to the impact zone and the specific alternatives being considered. A variety of organizations may have planning materials related directly to the sponsors' concerns. Search for data describing past environmental conditions in the area. The literature review should be in proportion to the scope and scale of the project.

   Persons who work on IDT's need to become familiar with the information resources available at area colleges and universities. Rapid entry to this literature can be accomplished by talking to staff specialists, each of whom often has personal collections for his own discipline. Use computerized literature retrieval systems (for example, CAIN, USDA, Washington, D.C., has 700,000 bibliographic citations from the National Agricultural Library, January 1976). Experienced IDT members already have much of the needed literature and will spend little time on this step. Following are some additional potential sources of information:

   - Colleges and universities
   - U.S. Fish and Wildlife Service, Bureau of Land Management, and Bureau of Reclamation
   - Environmental Protection Agency and the Corps of Engineers
   - U.S. Forest Service, Extension Service, Agricultural Research Service, Agricultural Stabilization and Conservation Service, and Economic Research Service
   - State agencies (such as geological surveys, state historical groups, departments of natural resources)
   - U.S. Geological Survey
   - National Park Service (National Register of Historic Places)
   - Regional planning agencies
   - Private environmental organizations
   - Consulting firms

2. Select an evaluation system

   After existing pertinent literature has been retrieved and examined, select a system or systems for detailed environmental assessment. Detailed assessment methods include comprehensive matrix analysis, network analysis, checklist approaches, overlay methods, and a variety of other systems of evaluation.

   Depending on the size, complexity, and kind of planning action being considered, certain methods are more useful than others. Publications are available that discuss the advantages, disadvantages, and situational utility of the

different systems of assessment. (See Jain and Urban, 1975, Appendix A.) For many SCS-assisted planning actions, network analysis to trace and find impacts, followed by the development of specific checklists to schedule data collection, is the most efficient strategy for detailed assessment. Note that the complexity and detail of any assessment method must be carefully tailored to the unique aspects of each planning situation. A brief discussion of four major systems follows:

a. The overview type of matrix analysis was discussed in connection with the initial phase of assessment. Matrix analysis indicates mainly areas of first-order environmental interaction. For detailed assessment, more complex matrices that account in greater detail for alternative planning actions can be prepared. For example, stepped or three-dimensional matrices are sometimes used to help account for second-order cause and effect sequences.
b. Ecological or network analysis is the systematic tracing of cause-and-effect sequences that lead to significant impacts. The resulting network diagrams help identify the interrelationships between components of ecological systems. (See Appendix C for an example.) Whereas matrix analysis identifies areas of environmental concern, network analysis shows what these concerns are and what data are needed to measure their effects.

   This tracing of causes and effects is the part of assessment that requires the greatest technical skill and is the point where interdisciplinary influence is most vital. It permits analysts to discover unsuspected effects and impacts and leads naturally from past conditions to predictions of future conditions. It tends to be a deductive method because existing conditions and probable effects are estimated and then environmental data are collected to document conditions and aid in predicting impacts.

   Analyze each alternative and plan element, including future without a plan, to determine potential impacts. Impacts may be caused by the inputs required to carry out a measure, by the measure itself, or by the outputs resulting from it.

   Determine which evaluation factors would change as a consequence of developing each alternative. Network analysis should surface all significant impacts of the first, second, and subsequent orders.

   Temper the tracing of causes and effects so that only significant effects are ultimately considered. Significance

is established by determining whether an effect is of sufficient magnitude to have a material bearing on decisionmaking. The IDT makes this determination and documents its reasoning in the support file. Be sure to include all environmentally important information without overloading planning with excessive detail.

There are assessment situations where previous network diagramming has thoroughly delineated the ecological relationships and the IDT can proceed directly to preparing the checklists. Any decision to skip network analysis should be a deliberate one made by the IDT after the field examination.

Some degree of network analysis is needed in most detailed assessment efforts. For very large projects with numerous alternatives and subcomponents, network analysis can be done by project subareas to prevent schematic displays from becoming too complex. Note that completed network diagrams are a convenient basis for preparing work schedules and report outlines.

c. Checklist assessment systems are general listings of resource elements and parameters that can be investigated to detect possible impacts. General checklists are excellent as reminders of environmental data that may be needed. Such checklists are also useful as a format for displaying data in environmental assessment summaries. Use checklist systems with some kind of network analysis for best results. This will help in identifying those evaluation factors unique to specific projects and help avoid the collection of more data than are needed. Appendix D is an example of a general checklist system for environmental assessment (adapted from Environmental Assessment Procedure, SCS, 1974).

Each major element in the SCS checklist system (such as land, water, air) is evaluated according to specific parameters (such as volume of flow, dissolved oxygen, etc.). Each parameter is an individual impact indicator. Considered in total, these parameters can signal the consequences of different resource actions.

Considerable technical skill is needed to decide which parameter on a checklist needs to be studied during assessment. Evaluation standards need to be applied to the original assessment data to interpret importance. Evaluation standards are provided by SCS specialists for each technical field. For example, SCS Engineering Technical Release 58, provides information on selecting water-quality parameters and evaluating data.

d. Overlay methods consist of superimposed sets of maps containing various kinds of resource use interpretations, basic resource data, and project alternatives. At any point in the analysis, alternative locations on the overlay map that transmit the most light are the least environmentally damaging. Overlay maps are very useful in displaying data on linear corridor proposals (such as pipeline or highway locations) for the purpose of selecting the least damaging route. Overlay systems lend themselves well to computerization. McHarg, 1969, (Appendix A) provides an extensive treatment of this subject.

3. Resource data retrieval
After the possible effects and potential impacts have been anticipated through network or other analysis, IDT members can prepare specific checklists of those evaluation parameters needed to characterize the present and predict possible future environmental conditions. Once this is done, as in the last column of the network analysis example, retrieve from existing sources any of the needed data to minimize expensive field collection. Examples of possible sources include STORET, WATSTORE, and NAWDEX [1/] for water-quality data. Persons working on IDT's should keep themselves well informed of sources of data for their disciplines and geographic areas.

Examine the retrieved data and pertinent literature with the dual objective of improving the design of the assessment model and of satisfying as much of the checklist of needed environmental data as possible. Prepare a field checklist of the data and information that must be collected in the field.

4. Written study plan
As the last step in developing strategy, prepare a written plan for completing detailed assessment. This can range from a simple work schedule for a minor proposal to a detailed critical-path analysis for a highly complicated project. (See RC&D Handbook and Watershed Protection Handbook.) Clearly specify the following items:
- Team leader
- Components of work
- Time periods for completing work
- Responsible team members for each data summary
- Scheduled completion dates for summaries
- Team member responsible for preparing overall assessment summaries

---

1/ These acronyms are titles of water-quality data systems maintained by the U.S. Environmental Protection Agency and U.S. Geological Survey.

B. Describe present conditions

This part of the detailed assessment is devoted primarily to collecting data on existing environmental conditions using the field checklists as a guide. Some data are collected by IDT members working separately and other parts of the data are collected jointly but interpreted individually. Some of the data can be collected and interpreted by consulting firms functioning as IDT members. Hold periodic team meetings to coordinate field work and provide interdisciplinary influence on data interpretation.

To simplify organization and review of support files and various summaries and reports, environmental assessment can be organized and displayed in the format of basic resources (land, water, air) and resource uses (such as crop production, recreation, wildlife habitat, fish habitat, social uses, natural area, historical, and municipal water supply). A comprehensive example of this format is contained in Appendix D. This pattern of data display lends itself well to most SCS-assisted projects and is easily understood by non-SCS persons cooperating in assessment.

Describe fully the existing environment in terms of quantity and quality for each basic resource and resource use factor. In evaluating basic resources and resource uses, specify all significant physical, biological, social, and economic components, and their interactions. Evaluate only those parameters identified as significant during network or other analysis or discovered as significant during field work.

C. Predict future conditions (with and without project)

A variety of techniques is available to assist in estimating future conditions including trend extrapolation, pattern identification, probabilistic forecasting, models, simulations, and scenarios. (See Handbook of Forecasting Techniques, Appendix A.) Expert judgment about existing systems and forecasting methods is needed to produce reliable data. Some agents of change to consider in predicting future environmental conditions with and without project are:

- Successional changes in ecosystems that are occurring or will occur
- Cultural disturbances that are occurring or will occur
- Probable physical events
- Hypothetical changes associated with different alternatives

Forecasts of future environmental conditions are often based directly or indirectly on current conditions. Such methods yield useful predictions for natural, social, or economic systems that tend toward dynamic equilibrium or apply to short time periods. Conversely, basing forecasts on existing conditions is often a poor method for disturbed or unstable systems or for long time periods.

The prediction of future conditions includes anticipating futures that would be associated with each alternative including future without a plan. Alternatives are generated by sponsors, concerned publics, and the IDT during planning. Continue the evaluation of alternatives until the cause-and-effect sequences and data needs delineated by network or other analysis have been traced and satisfied. Following are some general considerations relating to predicting future environmental conditions.

1. All predictions are based on conceptual models of reality. These models range from totally intuitive to highly rational. Both may yield useful predictions of future environmental conditions. Technical specialists on the IDT at the project planning level should select the methods for forecasting future conditions. Specialist members of IDT's must be well informed about and use those methods, models, and techniques that are most acceptable professionally in the disciplines they represent.

   Complex models requiring major investments in staff and equipment are, in most cases, not justified for typical SCS-assisted projects unless the resulting computer hardware and software can be made to apply to other projects of that type.
2. Extrapolation of existing trends is the most common method of forecasting future conditions without the project. It is done by extending past environmental trend data to future points in time. Proper use of this technique includes guarding against the problem of inadequate trend data and using common sense in evaluating the resulting predictions. Uncertainties and the limitations inherent in all forecasting methods can be recognized by assigning ranges of values to predicted future conditions.
3. Consider the limits of prediction. Past efforts to predict specific conditions in the future have often proved to be highly inaccurate. Future conditions are often very difficult to predict, particularly beyond 20-25 years. This is one reason for expanding probable error limits for predictions of future conditions as prediction time is extended. This is also a valid reason for limiting predictions of future conditions to as short a period of time as practicable.
4. Past experience with similar proposals or similar resources responding to analogous changes may offer a convenient model for predicting probable futures. Using analogous situations, with carefully stated assumptions, is sometimes the only practical means of predicting impact (Dickert, 1974). Future predictions based on these kinds of analogies are usually credible.

5. Network analysis is an excellent way to identify potential environmental conditions associated with alternative futures and to detect otherwise obscure trend factors (Appendix C).
6. In constructing models for predicting future environmental conditions, be especially alert to the value of the "what if" approach to detecting obscure trends. The "what if" technique is stimulating the intuition and imagination of IDT members by postulating a variety of resource management situations and their resulting impacts, even some unlikely ones.

D. Calculate environmental impacts
The differences between future conditions without the project and predicted conditions under the various with-project alternatives are the environmental impacts. If predictions of future conditions are adequate, determination of impacts is essentially a bookkeeping task and usually does not require additional field work. Specify impacts as clearly as possible in technical terms and do not label them as good or bad in a technical sense unless the evidence is coercive. The broader labeling of impacts as favorable or unfavorable in a public policy sense should be done later in planning (such as when a draft EIS is prepared) after public participation has clarified the political value judgments.

E. Detailed assessment summaries
The planning support file should contain a reviewable record consisting of data, reports, specific and overall technical summaries, and other material relating to detailed assessment. The resulting store of data can be assembled and arrayed in various forms to fit a variety of planning needs. Needs will vary depending on the program and the actual type of measure.

This guide is not meant to stimulate separate new assessment reports. To the extent possible, assessment summaries should be written as inputs to (or actual parts of) field examination reports, preliminary investigation reports, draft and final EIS's, and various other documents needed throughout planning.

The two general kinds of assessment summaries described below may be adapted to meet individual planning needs:
1. Technical assessment summary with tabular and graphical displays.--This summary is an indepth documentation of the assessment findings of the IDT. It contains the environmental data, conclusions, and recommendations for each alternative considered. Environmental assessment checklists and network diagrams may be appropriate analytical and display devices to use.

   Assessment summaries normally are based on and supported by written reports and summaries prepared by each technical field represented on the IDT. Exact format and content are the responsibility of the IDT leader and individual specialists. Bringing assessment summaries together in a

truly interdisciplinary atmosphere of comment, challenge, controversy, consensus, and synergy is a major task of the IDT leader.

2. Executive assessment summary.--This summary is an overall narrative in laymen's language, accompanied by limited graphic and tabular summaries of data. These summaries can be provided to sponsors and other interested public groups as needed during planning. Executive summaries may make recommendations about mitigation or enhancement measures, preferable alternatives, or the need for additional study based on purely technical considerations. A brief summary of the supporting reasoning should be included.

   In project planning, these summaries are normally prepared just before the preliminary report or the preliminary investigation report in RC&D and watershed planning, respectively. In some other situations, assessment summaries can be prepared as preliminary drafts of technical appendixes or as preliminary draft EIS's, as appropriate.

IV. THE SUPPLEMENTAL PHASE OF ASSESSMENT

As the need for additional environmental data arises during later stages of planning, the IDT should reassess its earlier work and make any needed supplemental assessment. Plan formulation often requires repeating parts of the overall planning process. As noted in USDA Procedures for Water and Related Land Resources, one of the reasons for reiteration of planning is that the level of detail in environmental assessment is inadequate as a basis for selecting a recommended plan. When this is so, it is necessary to make additional assessment for selected alternatives unless the needed data can be obtained from the planning support file.

Supplementary assessment basically consists of convening the IDT, discussing the new planning needs, expanding the strategy for assessment, preparing a list of needed supplementary data, collecting the data, revising or adding to the predictions of alternative future conditions, and revising the summaries and displays of data for decision makers. This work should proceed rapidly because of the existing extensive data base and analytical models used during earlier phases of assessment. Maximum advantage should again be taken of existing data retrieval sources. Again, all new significant environmental information should be placed in the planning support file. It may be necessary to go through more than one cycle of supplementary assessment in response to overall planning needs.

# # # # #

Appendix A.--A list of selected references relating to environmental assessment

Alden, Howard R. 1974. Environmental impact assessment: a procedure for coordinating and organizing environmental planning. Thorne Ecol. Inst., Boulder, Col., Tech. Pub. 10.

Central New York Regional Planning and Development Board. 1972. Environmental Resources Management. Prepared for HUD. (Available through U.S. Natl. Tech. Inf. Serv., PB 217-517.)

Dee, N., J.K. Baker, N.L. Drobny, K.M. Duke, and D.C. Fahringer. 1972. Environmental evaluation system for water resources planning. Report to the U.S. Bur. Reclam. Battelle Mem. Inst., Columbus, Ohio.

Dee, N., N.L. Drobny, J.K. Baker, K.M. Duke, and D.C. Fahringer. 1973. Planning methodology for water quality management: environmental evaluation system. Battelle Mem. Inst., Columbus, Ohio.

Dickert, Thomas G. 1974. Methods for environmental impact assessment: a comparison. In environmental impact assessment: guidelines and commentary. Univ. Calif., Berkeley, Calif.

Jain, R.K., and L.U. Urban. 1975. A review and analysis of environmental impact assessment methodologies. Constr. Eng. Res. Lab. Tech. Rep. E-69, 22 p. Champaign, Ill.

Krauskopf, T.M., and D.C. Bunde. 1972. Evaluation of environmental impact through a computer modeling process, p. 107-125. In Robert Delton and Thomas Goodale (ed.). Environmental impact analysis: philosophy and methods. Univ. Wis. Sea Grant Program, Madison, Wis.

Leopold, Luna R., Frank A. Clark, Bruce R. Hanshaw, and James R. Balsley. 1971. A procedure for evaluating environmental impact. U.S. Geol. Surv. Circ. 645.

McHarg, I. 1969. Design with nature, p. 31-41. Natural History Press, Garden City, N.Y.

Mitchell, A., H.D. Burnham, P.G. Kruzic, D.C. Miller, P. Schwartz, and B.E. Suta. 1975. Handbook of forecasting techniques. Stanford Res. Inst. Center for Study Soc. Policy, Menlo Park, Calif. 314 p. (Prepared for Inst. Water Resour. U.S. Army Corps Eng.)

Sorenson, J. 1971. A framework for identification and control of resource degradation and conflict in the multiple use of the coastal zone. Univ. Calif. Dep. Landscape Agric., Berkeley, Calif.

__________ and J.E. Pepper. 1973. Procedures for regional clearinghouse review of environmental impact statements, phase two. Report to Assoc. Bay Area Governments.

Stover, L.V. 1972. Environmental impact assessment: a procedure. Sanders and Thomas, Inc., Miami, Fla.

University of Georgia Institute of Ecology. 1971. Optimum pathway matrix approach to the environmental decision making process. Test case: relative impact of proposed highway alternatives. Athens, Ga.

U.S. Army Corps Engineers, Tulsa District. 1972. Matrix analysis of alternatives for water resource development, Draft tech. pap.

Appendix B.–

AN EXAMPLE OF A MATRIX TO DISPLAY BROAD AREAS OF ENVIRONMENTAL RELATIONSHIP

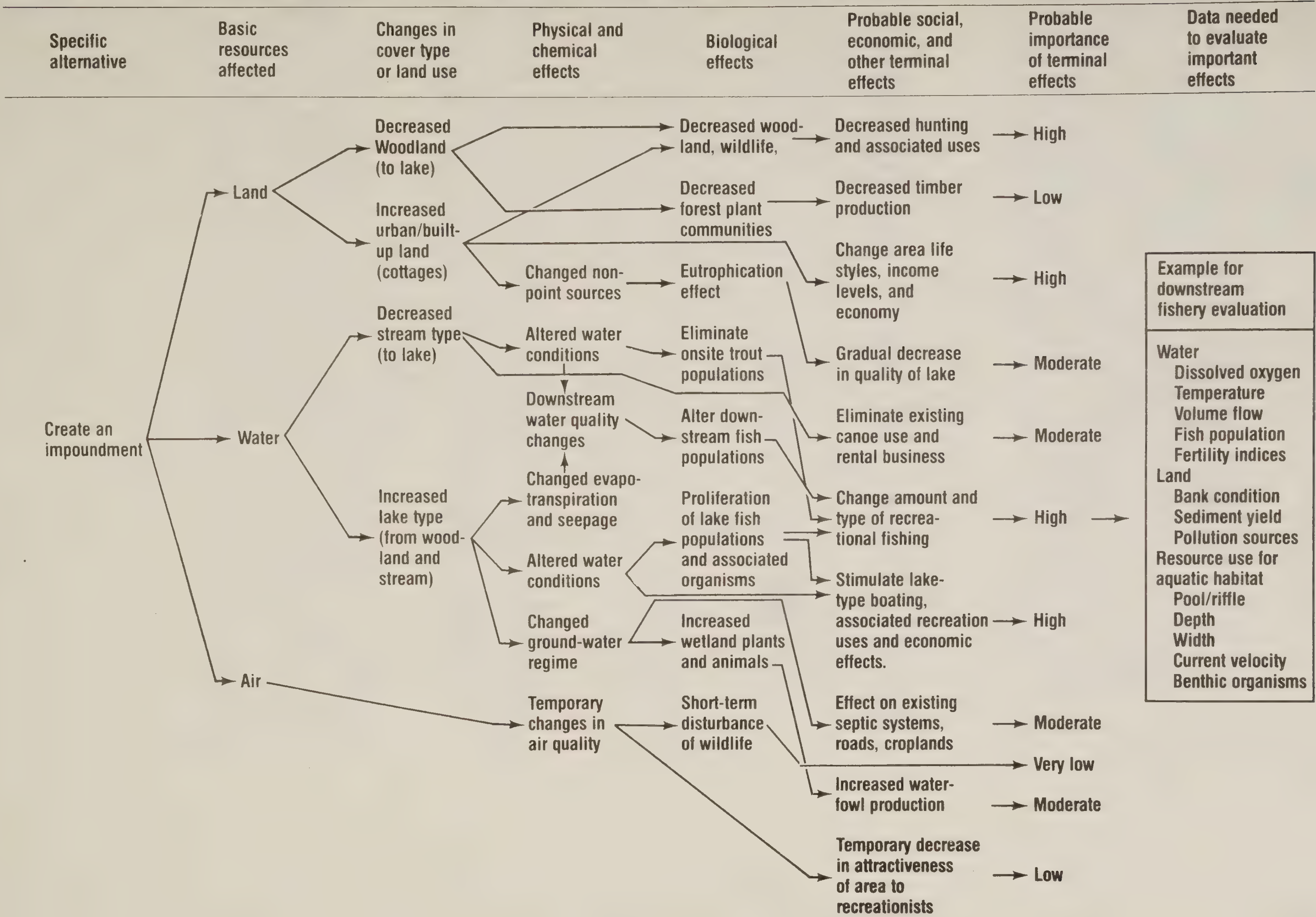
ENVIRONMENTAL FACTORS		POTENTIAL ALTERNATIVES				
		Future without a plan	Single purpose impoundment	Land treatment	Channel alteration	Multiple purpose impoundment
BASIC RESOURCES						
LAND	Cover type	Ø	0		0	Ø
	Erosion hazard	Ø		●	0	
	Flood hazard	●	●		●	●
WATER	Lake quantity		0			0
	Lake quality	0	Ø			Ø
	Stream length		Ø		0	Ø
	Stream quality	Ø	Ø	Ø	●	Ø
	Ground-water quantity		0		Ø	0
	Ground-water quality				Ø	0
AIR	Particulates & toxic gases					
	Odor		0			0
	Noise		0		0	0
RESOURCE USES						
	Crop production	Ø		0		
	Pasture production					
	Woodland production		Ø			Ø
	Wildlife production	0	Ø	Ø	0	Ø
	Recreation	Ø	●		Ø	●
	Municipal & industrial water	Ø				●
	Mineral extraction					
	Low-flow augmentation					Ø
	Irrigation water					
	Fish production	Ø	●		●	●
	Economic development – National		0		0	Ø
	Economic development – Regional	Ø	Ø		Ø	●
	Social values		0			●
	Unique cultural/historical/natural		0			0
	Visual	0	Ø	0	●	0

RELATIONSHIP

0 Slight   Ø Moderate   ● Important

Appendix C.—

AN EXAMPLE OF A NETWORK DIAGRAM FOR ANALYZING PROBABLE ENVIRONMENTAL IMPACTS



APPENDIX D.--An example of a general checklist system for environmental evaluation

Checklist systems of evaluation are commonly used environmental assessments. Presented here is a general system that, with variations to meet individual programs and local conditions, can be used as a reminder of the environmental conditions that should be analyzed. This material was adapted directly from Environmental Assessment Procedure, Soil Conservation Service, USDA, May 1974. Some changes were made in response to suggestions from the field. TSC's and states should modify this system as necessary to meet regional and local conditions. Also, note that SCS technical specialists change these methods as better techniques become accepted in each technical field.

Using this procedure

The basic procedure for using this system consists of selecting the basic resource and resource use data sheets needed for a particular project, adding or deleting individual parameters, collecting data and entering values on the sheet, developing relative weightings for each parameter, and summarizing the data. These activities should be done by a balanced IDT using detailed technical procedures and evaluation criteria approved by specialists in each technical field.

Display of output for decision makers

The procedure provides four tabulations of data to assist environmental analysts and decision makers: (1) basic resource quantity levels, (2) basic resource quality levels, (3) resource use ratings, and (4) resource use summary ratings. For each tabulation predictions of future conditions with and without project are made.

Individual assessment sheets in this example contain a mixture of metric and English units of measure. The units listed for each parameter represent the standard in each technical field at the time this guide was written. Metric units are gradually being adopted and users should change English units to metric units as appropriate.

Present conditions

The profile of present conditions describes the physical, biological, economic, social, and other characteristics of the area likely to be affected by the proposed actions. Judgment is critical, both in determining impact boundaries and in selecting relevant indicators. The impact boundaries vary, depending on whether the focus of the indicator and the extent of the proposed action are local or regional and on whether the boundaries are determined by political, economic,

cultural, hydrologic, or ecologic units. For example, the area of influence of a proposed watershed project may well extend beyond the hydrologic boundaries of the project area. This is particularly true for economic effects if the primary trade center is outside the boundaries of the proposed project. The impact of a project on a large stream may influence conditions far beyond other project boundaries.

The profile of present conditions can be started during the initial phase of assessment. As alternatives are considered in greater detail, the profile can be refined and further focused on significant effects. When completed, the profile should clearly present the existing significant conditions, problems, needs, and the rationale for proposed alternatives.

This assessment system requires the compilation and evaluation of many kinds of data. Some of the data can be obtained from outside sources, such as federal, regional, state, and local agencies, regional and state clearinghouses, planning authorities, river commissions, and universities.

If needed information is not available, it is necessary to collect new data. Appropriate agencies such as the USDA, Agricultural Research Service, U.S. Environmental Protection Agency, and corresponding state agencies such as health, air quality, and water quality agencies should be asked to assist with the development of data collection and interpretative procedures. American Society for Testing and Materials and other standards are available for measuring indicators. Their use provides uniformity and acceptance of the measurements and is encouraged.

Predicting probable conditions that would occur under the without action and various with-project alternatives

Predict conditions following the without action alternative and each with-project alternative being considered. Estimate the impact both during installation and throughout the expected life of the action. Identify and evaluate cause-effect relationships between the alternatives and the environmental indicators being considered. The evaluation for each alternative is to be set forth in enough detail to insure that all significant interaction relationships are considered. Procedures for predicting future environmental conditions, to the extent they are available, are provided by technical specialists in SCS.

Basic resources

Land quantity levels

Dominant land use categories can be used for assessing land quantity and quality. Land use can be subdivided as needed by different technical specialists.

Often it will be desirable to consider cover types in addition to land use in land quantity analyses. When this is done, we suggest using the classification system detailed in "A Land Use and Land Cover Classification System for Use with Remote Sensor Data," Professional Paper 964, U.S. Geological Survey, 1976. The first level of the USGS classification system is also shown in the following example.

A sample form for assessing land quantity levels for each dominant land use and cover type follows. Entries are in terms of acres of each dominant land use or cover type.

ASSESSMENT SHEET

Land quantity levels

Description of area: (County, watershed, state, major land resource area, etc.)

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Land use						
Cropland	acres					
Pastureland	acres					
Rangeland	acres					
Forestland	acres					
Wildlife land	acres					
Urban land	acres					
Recreation land	acres					
Other land uses, e.g., surface-mined land	acres					
Water	acres					
Total	acres					
Cover type						
Urban or built-up land	acres					
Agricultural land	acres					
Rangeland	acres					
Forestland	acres					
Water	acres					
Wetland	acres					
Barren land	acres					
Tundra	acres					
Perennial snow or ice	acres					
Total	acres					

NOTE: The IDT may decide to use one or both of these classification systems.

Land quality levels

The guidelines for assigning quality levels to the land types shown in this section need to be tailored to local conditions. Much of the information used for evaluation indicators can be taken from existing records, such as soil surveys, range studies, woodland soil-site studies, soil interpretation records for named kinds of soils, and from other sources.

Examples of quality indicators to be considered for land uses are soil limitations such as degree and kind of erosion, flood hazard, and deposition (wind and water). Other indicators are important for one land use and not for another.

Cropland.--Soil management systems, production potential, water management system.

Pastureland.--Production potential, soil management systems, water management system.

Rangeland.--Quality or condition, woody plants, poisonous plants.

Forestland.--Suitability, species composition, stocking, forage production (understory potential).

Wildlife land.--Wildlife habitat management system.

Urban land.--Land developed to include design that overcomes soil and/or site limitations.

Recreation land.--Land developed to include design that overcomes soil and/or site limitations.

Other land uses.--For example, mined land.

ASSESSMENT SHEET

Land quality levels

Description of area: ____

____

			Future conditions			
			Planning alternatives			
		Present	Without	With project		
Parameters	Unit	conditions	project	1	2	3
Gross erosion	acres					
A. ____ton or less/ac/yr						
B. ____to___t/ac/yr						
C. ____to___t/ac/yr						
D. ____to___t/ac/yr						
E. ____t/ac/yr or more						
Flood hazard 1/ total flood plain	acres					
A. Previously flood proofed						
B. Subject to flooding						
C. No. of inhabitable properties						
D. No. of commercial & industrial properties						
Deposition, wind, or water (expressed in terms of range and kind of deposition in study area)						
Prime and unique farmland	acres					
Wetland, by category and type 2/	acres					
Salinity	acres					
Alkalinity	acres					

1/ May be expressed in frequency and/or duration.

2/ Classify wetland by category and type as in U.S. Fish and Wildlife Service Circular 39.

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ____________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Considerations for specific uses						
Cropland						
Soil management systems	acres					
A. Adequate (item code 690)						
B. Not adequate						
Production potential	acres					
A. More than 90% of potential						
B. 70 to 90% of potential						
C. 50 to 70% of potential						
D. 30 to 50% of potential						
E. Less than 30% of potential						
Water management systems	acres					
A. Drainage, total 1/						
1. Adequate						
2. Not adequate						
B. Irrigation						
1. Adequate						
2. Not adequate						

1/ Total acres of cropland that would benefit from drainage practices whether installed or not.

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ____

____

			Future conditions			
			Planning alternatives			
		Present	Without	With project		
Parameters	Unit	conditions	project	1	2	3
Pastureland						
Production potential	acres					
A. More than 90% of potential						
B. 70 to 90% of potential						
C. 50 to 70% of potential						
D. 30 to 50% of potential						
E. Less than 30% of potential						
Soil management systems	acres					
A. Adequate						
B. Not adequate						
Water management systems	acres					
A. Drainage, total [1/]						
1. Adequate						
2. Not adequate						
B. Irrigation						
1. Adequate						
2. Not adequate						

[1/] Acres of pastureland that would benefit from drainage practices whether installed or not.

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Rangeland						
Quality or condition	acres					
A. Excellent ecological condition						
B. Good ecological condition						
C. Fair ecological condition but sufficient cover to protect soil						
D. Fair ecological condition with slight to moderate erosion or poor ecological condition but with sufficient plant cover to protect soil						
E. Poor ecological condition with insufficient plant cover to protect soil						
Woody plants	acres					
A. No problems						
B. Problems						
Poisonous plants	acres					
A. No problems						
B. Problems						

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ____

____

<table>
<tr><th rowspan="3">Parameters</th><th rowspan="3">Unit</th><th rowspan="3">Present conditions</th><th colspan="4">Future conditions</th></tr>
<tr><th colspan="4">Planning alternatives</th></tr>
<tr><th>Without project</th><th>With project 1</th><th>2</th><th>3</th></tr>
<tr><td>Forestland</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Wood production forests</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Woodland suitability (site class for indicator species)</td><td>acres</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A 1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B 2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>C 3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>D 4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>E 5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Acceptable growing stock</td><td>acres</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A. Stand has more than 70% acceptable growing stock</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B. Stand has 50 to 70% acceptable growing stock</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>C. Stand has less than 50% acceptable growing stock</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Stocking (density)</td><td>acres</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A. More than 70% stocked</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B. 50 to 70% stocked</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>C. Less than 50% stocked</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ____

Parameters	Unit	Present conditions	Future conditions: Planning alternatives — Without project	With project 1	2	3
Wood production forests (con.)						
Forage production (understory)	acres					
A. More than 80% of potential						
B. 70 to 80% of potential						
C. 50 to 70% of potential						
D. 30 to 50% of potential						
E. Less than 30% of potential						
Environmental forests	acres					
Acceptable growing stock						
A. More than 70%						
B. 50 to 70%						
C. Less than 50%						
Stocking density						
A. More than 70%						
B. 50 to 70%						
C. Less than 50%						

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Forestland (con.)						
Christmas tree and speciality forests	acres					
Production potential						
A. More than 70%						
B. 50 to 70%						
C. Less than 50%						
Wildlife land						
Wildlife habitat management system	acres					
A. Adequate						
B. Not adequate						
Urban land (includes specialized land uses)						
Land developed to include designs that overcome the soil and/or site limitations						
A. Adequate						
B. Not adequate						
Recreation land						
Land developed to include designs that overcome soil and/or site limitations	acres					
A. Adequate						
B. Not adequate						

ASSESSMENT SHEET

Land quality levels (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Other land uses (example follows)	acres					
Mined land						
Active	acres					
Stabilized and revegetated, including control of sediment and leachates						
A. Adequate						
B. Not adequate						
Inactive	acres					
Stabilized and revegetated, including control of sediment and leachates						
A. Adequate						
B. Not adequate						
Subsidence						
Area affected	acres					

Water quantity levels

The water resource includes surface and underground water and both quantity and quality are measured.

Describe streams in terms of average monthly discharge in cubic feet per second (cfs) and average annual discharge volume in acre-feet. Give minimum flows in cubic feet per second (cfs). Summations of periods with a 50-percent chance of no-flow occurrence in any one year can be shown as days/year. If significant for a possible use, give other frequencies and times. Describe stream size by width and depth increments for channel reaches. If pools and riffles are significant, show them in miles or percentage of the channel reach in question. Give streambank length in miles as measured on one or both sides, depending on the width of the stream.

Give storage in lakes or reservoirs in acre-feet; but if sustained yield is important because of municipal or industrial water use, show the sustained yield in million gallons per day (mgd). Give surface area of a water body in acres. If average depth is significant, show the area as an average depth of acres by depth increment, i.e., less than 3 feet deep, 80 acres; from 3 to 5 feet deep, 100 acres; etc. Give ground-water volume available for use on an annual basis in acre-feet. Show depth to the ground-water aquifer if significant for a possible use. If annual ground-water use exceeds recharge, give the expected life in years.

Other physical properties of a water resource should be inventoried where necessary to determine the impact of the proposed project. A sample assessment sheet of quantity indicators follows.

ASSESSMENT SHEET

Water quantity levels

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Streams						
Perennial	miles					
Intermittent	miles					
Ephemeral	miles					
Average discharge by months	cfs					
Average annual discharge	ac-ft					
Minimum flow	cfs/days					
No flow	days/yr					
Stream size by reach width ___ to ___ depth ___ to ___	miles					
Streambank	miles					
Type of stream channel[1/]						
Lakes or reservoir						
Effective storage	ac-ft					
Surface area	acres					
less than feet deep ______	acres					
to _____ feet deep	acres					
Shoreline	miles					
Ground water						
Major springs	no.					
Available storage	ac-ft					
Expected life	years					

[1/] Natural or manmade.

Water-quality levels

Water quality must be related to uses and standards. Most states have developed standards for their water resources.

Some of the more common water-quality indicators are shown on the sample water-quality level assessment sheet. Other indicators may need to be added and some may need to be deleted. The pertinent indicators may need to be measured at several locations in the project area, depending on need and proposed use.

Considerable data are available from federal agencies, including the Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS), and their corresponding state agencies. Local government agencies such as water and sanitary districts are also good sources. The IDT will determine what data are available and make arrangements for any additional testing. Procedures for sampling and testing should be in accordance with recognized standards. These include: Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association; the water section of the American Society for Testing and Materials book of standards; or applicable methods in EPA manuals for analyzing water.

ASSESSMENT SHEET

Water quality levels

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Physical properties						
Discharge	cfs					
pH	no.					
Odor Intensity Index	no.					
Turbidity	Jackson units					
Suspended solids	mg/l					
Water temperature	°C					
Air temperature	°C					
Radio activity	μCi/ml					
Electrical conductance	μmho/cm					
Chemical properties						
Major cations						
Ca^{++} (calcium)	mg/l					
Mg^{++} (magnesium)	mg/l					
Na^{+} (sodium)	mg/l					
SAR (sodium adsorption ratio)	no.					
Acidity	meq/l					
Alkalinity	meq/l					

ASSESSMENT SHEET

Water quality levels (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Major anions						
Cl^- (chloride)	mg/l					
$SO_4^=$ (sulfate)	mg/l					
HCO_3^- (bicarbonate)	mg/l					
DO (dissolved oxygen)	mg/l					
COD (chemical oxygen demand)	mg/l					
Dissolved solids	mg/l					
Nitrogen compounds	mg/l					
Phosphorus	mg/l					
Toxic chemicals	mg/l					
Biological properties						
Coliforms (USPHS total)	MPN/ 100 ml					
Coliforms, fecal	MPN/ 100 ml					
Streptococcus, fecal	MPN/ 100 ml					
BOD (biological oxygen demand)	mg/l					

Air quality levels

Air quality is an important consideration in environmental assessment. Examples of indicator groupings considered important for assessing air quality are particulate matter, polluting gases, odor, patterns of movement, noise, and visibility. Use standard units of measure (ASTM or others) where applicable. Indicators in addition to those shown on the air quality level assessment sheet that follow may be important in some areas and should be used.

ASSESSMENT SHEET

Air quality levels

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
(Consult ASTM D-1356 for definitions)						
Particulate matter						
Pollen, peak season	months					
Pollen, count	no./m^3					
Smoke, fly ash	g/m^2/month					
Dust and other particulate matter	g/m^2/month					
Less than 2 microns	g/m^2/month					
2 to 20 microns	g/m^2/month					
More than 20 microns	g/m^2/month					
Visibility	miles or km					
Polluting gases						
Carbon monoxide	mg/m^3					
Nitric oxide, nitrogen dioxide	mg/m^3					
Ozone	mg/m^3					
Sulfur dioxides	mg/m^3					
Ammonia	mg/m^3					
Hydrogen sulfide	mg/m^3					
Hydrocarbons	mg/m^3					

ASSESSMENT SHEET

Air quality levels (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Other odiferous components	mg/m^3					
Odor						
Odor	odor units/ft^3					
Patterns of movement						
Inversions	months and duration					
Air drainage and frost pockets	acres affected					
Noise						
Noise spectrum	frequency					
Intensity	decibels					
Repetitive character	frequency and duration					
Season of occurrence	month					
Time of occurrence	time of day					
Neighborhood	type					

Resource Uses

The quantity and quality determinations made in the previous section have a bearing on the suitability of the water, land, and air for each resource use. A lake may store floodwater, municipal water, and sediment while providing fish and aquatic organism habitat, recreation for boating and swimming, and an esthetically pleasing view. Various resource uses are evaluated as follows.

Cropland production

Crop production is rated in terms of expected/potential for all major crops. Expected is an expression of all average yields now. Expected future without action and with various alternatives reflects the influence of projected levels of management within a specific time frame. Potential production reflects the same time frame as expected but assumes (within reason) the use of known improved cultural and management techniques and technology. The list of crops includes those extensively grown and/or important crops produced in the study area. Standard units of measure are used for each crop. These differ according to the crop. The procedure follows.

1. Determine what production information is available.
2. Develop table showing by crop average yield per acre and acres grown.
3. Analyze data using soil surveys, aerial photographs, and/or overlays showing extent and location of major soils or groups of soils where each crop is grown. Example: corn may be grown mostly on moderately deep to deep, well to moderately well drained soils, including dominant mapping units; i.e., Chester, Duffield, Berks, etc. Take into account model cropping systems.
4. Analyze all the data collected using best experts available, arrive at consensus of potential production, expected production without program and with various alternative programs. Potential production may also differ for the various alternatives.
5. Expand production data to complete "Production potential" portion of assessment sheets depicting "Land quality levels."

RESOURCE USE
for

Cropland production

Description of area: ____________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Corn						
expected potential	bushels					
Wheat						
expected potential	bushels					
Soybeans						
expected potential	bushels					
Sugar beets						
expected potential	tons					
Grain sorghum						
expected potential	cwt					
Rotation pasture						
expected potential	aum					
Hay						
expected potential	tons					
Summary rating						

Fish habitat

Fish habitat evaluation usually includes consideration of the following four factors: (1) physical features of water areas, (2) biological productivity, (3) water quality, and (4) threatened or endangered species.

For lakes and ponds, display total acres in the physical feature inventory. Depth, water quality, and other data may also be displayed, as appropriate.

For streams, a model can be devised for each watershed, using selected stream features. Suggested features to consider are width, flow, pool-riffle ratio, percentage stream shade, pool quality, and riffle quality.

Biological productivity evaluations may include the following factors:

1. Fish (pounds of fish, diversity of species, and size relationship). If practical, determine the pounds of fish per mile by sampling. Consider local adaptation in rating diversity of species. Consider the percentage of fish of catchable size and the presence or absence of young of the year fish.
2. Benthic organisms. Beck's Diversity Index or a similar procedure can be used.
3. Other vertebrates present.
4. Water-quality limitations for fish and other aquatic organisms.

Threatened or endangered aquatic species, if present, should be evaluated and recorded.

RESOURCE USE
for

Fish habitat

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Lakes or ponds	acres					
Water quality	rating					
Biological productivity						
Fish	lb/ac					
Threatened or endangered species	number					
Streams						
Physical features	mi/ mi value					
Biological productivity						
Fish	lb/mi					
Diversity	rating					
Size	rating					
Benthic organisms	index					
Other vertebrates (list)	no.					
Water quality	rating					
Threatened or endangered species (list)	number					
Summary rating						

Industrial water supply

Evaluation of the industrial water supply is related to the needs of the industry to be served and to the type of industry. Limit the evaluation to (1) the current and projected needs of existing industries that depend on the supply, (2) the estimated current and projected needs of any new industries identified by the sponsors that will depend on the supply, and (3) the currently available supply and its potential for meeting the projected industrial demand.

Industrial need.--Industry representatives or the sponsor's consultants should identify the current and projected needs of the industry in million gallons per day for the projected life of the project. Show need by months if the demand is seasonal.

Quantity available.--Industry representatives or the sponsor's consultants should furnish the present and projected quantity and the source of industrial water supply. Show quantity by months if the supply varies. If the present and projected supply is interrelated with other uses such as recreation during certain seasons, indicate any restrictions, water rights, etc.

Quality available.--The ideal quality of water required for industrial use varies widely for the many purposes to which water is put. As a request, it is difficult to organize the quality requirements of water used for each of the many different industrial processes into standards. Individual industries have established specific water-quality criteria. When developing water resource projects with industrial water, be sure that the water quality will be suitable for the intended industrial use.

People employed.--Show numbers of people now employed and projected to be employed.

Net benefits.--Estimate the net benefits in dollars resulting from the improved industrial water supply.

Quality of the effluent.--The various state agencies have published water-quality standards. The Permit Assistance and Evaluation Division, Office of Water Enforcement, U.S. Environmental Protection Agency, Washington, D.C. 20460, has published "Interim Effluent Guidance for NPDES Permits," which establishes effluent criteria for specific industries. Publications can be obtained from the EPA regional offices. All industries are expected to meet minimum EPA criteria (by best practicable control technology currently available) by July 1, 1977. These agencies should be consulted to rate the quality of industrial effluent as adequate or not adequate.

Quantity of effluent.--Industry representatives or the sponsor's consultants should furnish the current quantity of effluent in million gallons per day and an estimate of the future quantity for the evaluation period. If the quantity varies, show the variation by months.

RESOURCE USE
for

Industrial water type industry

Description of area: ____

____

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Industrial need	mgd					
Quantity available	mgd					
People employed	no.					
Quality of effluent						
A. Adequate	mgd					
B. Not adequate	mgd					
Quantity of effluent	mgd					

Summary rating

Irrigation water

Evaluate water as a resource for irrigation of agricultural crops. Relate water requirements to water supply under present conditions, future without action, and identifiable alternative development plans. Assess the irrigation water not used by evapotranspiration that becomes available for other uses. Describe the economic feasibility of each alternative action in terms of net benefits.

Evaluate irrigation water requirements by considering such things as the extent and characteristics of the lands to be irrigated; type and quality of crop to be grown; consumptive use of each crop under the existing climatic conditions; irrigation method to be used; water application efficiency considering proper application depth, rate, and timing of irrigation; reuse of tailwater; and special water uses for plan quality, cooling, and frost protection. Evaluate efficiency of conveyance of the irrigation water from the point of supply to the point of use by considering such things as the type of and extent of the conveyance system; adequacy of control and measuring structures; seepage and management losses.

Assess the water supply available under present, future without action, and each alternative action in terms of quantity and quality. Evaluate separately water supplies available for diversion from direct streamflow and from storage, both surface and ground water. This evaluation includes assessment of the availability and quality of the water supply with respect to the irrigation season and the dependability of the supply. Legal restraints on availability must also be considered.

RESOURCE USE
for

Irrigation water

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Irrigation water requirements	ac-ft/yr					
Area served	acres					
Water use efficiency	%					
Conveyance efficiency	%					
Available supply						
Direct flow	ac-ft/yr					
Reservoir storage	ac-ft/yr					
Ground-water storage	ac-ft/yr					
Reuse	ac-ft/yr					
Quality	rating					
Adequacy to meet requirements	%					
Availability vs. time of need	rating					
Return waters						
Surface flow	ac-ft/yr					
Ground-water recharge	ac-ft/yr					
Quality	rating					
Summary rating						

Low flow

Evaluate low-flow maintenance or augmentation for effectiveness in improving stream characteristics. An alternative to the low-flow use section is to show the impact on other resource uses, e.g., fish resource use, municipal water supply use, industrial water supply use.

Low-flow maintenance or augmentation is accomplished by releasing water from impoundments or other sources into a stream in a predetermined manner. The purpose of such releases is to augment or increase the rate or duration of flow in a particular reach or in the entire stream unit in order to improve or enhance one or more of the environmental factors listed on the following resource use sheet.

As previously indicated under Water quantity levels, minimum flow is shown in cubic feet per second (cfs) with periods of no-flow given in days for the frequency of occurrence commensurate with the possible uses. Data on duration of no flow may be useful in evaluating the impact on other environmental factors such as fish and recreation.

Minimum-flow data may be readily available for some streams. If not, frequency analyses of stream-gage data from federal and state agencies or special studies are required.

The needs for water to improve or enhance other resource uses should be developed in consultation with personnel who have expertise in the particular fields under consideration. For example, the EPA provides data on the need for, value of, and impact of storage and releases for water-quality control in federal projects.

Assign a rating of 1 to 5 to low-flow augmentation for the resource use. Consider all environmental consequences of the low-flow regulation action, both adverse and beneficial. Even though storage and release of water may be planned for only one purpose, e.g., water quality, weigh both the positive and negative effects of the other resource uses in making the composite rating for low flow.

RESOURCE USE
for

Low flow

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Minimum flow	cfs/days					
Water quality	needed cfs					
Fish	needed cfs					
Wildlife	needed cfs					
Recreation	needed cfs					
Esthetic	needed cfs					
Summary rating						

Mineral extraction

This evaluation should be based on the quantity indicators for land and the quality indicators for land, water, and air. Because the potential hazards and environmental degradation due to surface mining, underground mining, and fluid mineral extraction are different, evaluate each of these categories of mineral extraction separately.

Surface mining (quarries, pits).--Surface mining of materials such as copper, iron, phosphate, and oil shale is generally on a large scale because of low unit value and/or large tonnage requirements.

Sand and gravel, dimension stone, and coal operations may be large or small.

Any surface mining operation generates large volumes of waste material, and all have the potential for contributing to air and water pollution because of extraction or processing procedures. Dewatering of deep pits or quarries can result in local lowering of the water table.

Spoil banks and gob piles themselves are often sterile and expensive to restore to a useful purpose. Abandoned (orphan) spoil banks will probably not be rehabilitated because of the high costs and the low priority for public funding.

Reclamation laws may or may not be adequate to insure proper reclamation of areas still subject to surface mineral extraction operations.

Spoil banks and gob piles are often major sediment sources, and runoff from coal-mined areas is acid and high in iron and sulphates.

Underground mining.--Underground mining and the associated processing operations often result in large volumes of waste material. Some of this material may accumulate as waste rock piles at the mine. These piles may be unstable and may be a major sediment source. More waste material is generated, usually as sludge or slurry, at processing or cleaning plants. Crushing or smelting operations may generate significant air pollution.

Underground excavations sometimes collapse, and this results in some degree of surface subsidence, which can be detrimental to overlying roads, railroads, dams, or buildings.

Waste water from mine dewatering or seepage, as well as waste water from cleaning and processing operations, may be of extremely poor quality.

Fluid mineral extraction.--Extraction of fluid (oil and gas) or fluidized (brine, sulfur) minerals can result in surface subsidence.

Ground-water contamination can result from improperly cased or sealed wells.

The potential hazard of spills must be considered, both at the well and at associated bulk storage and loading facilities.

RESOURCE USE
for

Mineral extraction

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without Project	With project 1	2	3
Active strip mines or quarries						
Industrial need	ton					
Quantity available	ton					
People employed	no.					
Pollution control						
Air						
Adequate	acre					
Not adequate	acre					
Water						
Adequate	acre					
Not adequate	acre					
Underground mines and processing plants						
Industrial need	ton					
Quantity available	ton					
People employed	no.					
Waste stabilization						
Adequate	acre					
Not adequate	acre					
Pollution control						
Air						
Adequate	no. of mines					
Not adequate	no. of mines					
Water						
Adequate	no. of mines					
Not adequate	no. of mines					

RESOURCE USE
for

Mineral extraction (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Fluid mineral extraction and facilities						
Industrial need	ton or bbl					
Quantity available	ton or bbl					
People employed	no.					
Pollution control						
Air						
Adequate	no. or acres					
Not adequate	no. or acres					
Water						
Adequate	no. or acres					
Not adequate	no. or acres					
Summary rating						

Municipal water supply

Municipal water supply is assessed on the quantity and quality of water needed and available under present and future conditions.

Municipal water supply needs are predicted from unit consumption per capita or number of hookups; such data are obtained from local municipal water utility organizations, water companies and districts, planning commissions, and demographic organizations.

Municipal water-quality ratings are determined by local or general Public Health Service drinking water standards. Consider the practicability of treating water to meet required standards and quality management.

Consider reuse of water for municipal, industrial, irrigation, or other resource uses. Sanitation districts and similar organizations can provide data relative to quantity and quality of effluent.

Cost and economic feasibility of municipal water may be useful in ranking the resource for this use compared to other possible uses.

RESOURCE USE
for

Municipal water

Description of area: ______________________________
____

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Population	no.					
Total hookups	no.					
Consumption per capita or hookup	gal					
Municipal water needs	mgd					
Quantity available	mgd					
Quantity vs. need	pct					
Quality	rating					
Water reuse						
Quantity	mgd					
Quality	rating					
Summary rating						

Pastureland production

Pastureland production is rated in terms of expected/potential in terms of animal unit months (aum). Expected is an expression of the average yield now. Expected future without action and with various alternatives reflect the influence of projected levels of management within a specific time frame. Potential pastureland production is a projection of possible yield within the same time frame as the expected but using, within reason, known improved cultural and management techniques and technology.

The same procedure used for cropland production can be adapted to determining pastureland production.

RESOURCE USE
for

Pastureland production

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project: 1	2	3
Forage - expected potential	aum/ acre					

Summary rating

Rangeland production

Rangeland production is expressed in terms of expected/potential range condition class for each range site. The range condition class designation reflects both quality and amount of production. Expected means that this is the present condition class level and that under future without action and alternatives. Potential means the condition rating possible with existing technology. The range condition class for a specific range site is determined in accordance with criteria in the local technical guide. Where local experience data are available and the grazing situation (season of use, kind and class of livestock, size of grazing units, etc.) is known, the range condition class can be further interpreted in terms of animal unit months of available grazing.

RESOURCE USE
for

Rangeland production

Description of area: ______________________________

Parameters		Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Range site A[1]							
	expected potential	range condition class					
Range site B[1]							
	expected potential	range condition class					
Range site C[1]							
	expected potential	range condition class					
Range site D[1]							
	expected potential	range condition class					
Etc.	expected potential	range condition class					
Summary rating							

[1] Use local name for each range site.

Recreation

Evaluate recreation as a use on the basis of the resources and activities available. Evaluate each significant activity as well as quality factors such as proximity, access, and water quality compared to the local and state water-quality standard for the proposed use, i.e., swimming, boating, etc.

Population in local area of influence.--Determine the present population in the local area of influence (usually a 2-hour drive). For columns headed future without and with, estimate the project population that will generate future demand, for example, 5 to 10 years after installation. Round out population to the nearest thousand. Finer calculations imply accuracy that is not consistent with the method.

Resource analysis.--Evaluate resource use on the basis of the resources and recreation activities available. The resources should include the quantity and quality of recreation land and water in the watershed and in the local area of influence. Calculate the quantity on the basis of acres of recreation land per 1,000 people and compared with standards for the state or with standards that provide adequate recreation opportunities for all persons.

Quality factors, such as proximity and access, should reflect the needs of the people in the specific area being served and reasonably or substantially attainable. Compare the water quality with local and state standards for the proposed use. The following quality ratings can be used: 1, unsuited; 2, poor; 3, neutral or fair; 4, good; and 5, excellent. Overall, the land or site must be suitable for the purpose for which it is intended.

Rate recreation facilities and developments within the watershed according to the same scale. When these areas are viewed or inventoried, note the following items to facilitate calculations of supply; number of campsites, number of picnic tables, square feet or linear feet of beach, acres of boating waters, fishing waters, and open hunting areas.

Activity analysis.--Estimates of supply (recreation visits per year) on existing recreation areas are based on the items listed, on the latest inventories by the National Association of Conservation Districts and the Bureau of Outdoor Recreation, or on estimates by the State Comprehensive Outdoor Recreation Plan, local recreation commission, etc. Base the estimate of supply in the future without action on the loss of facilities and installation of new or additional recreation facilities by other agencies, government units, programs, private entrepreneurs, etc. Supply in alternatives is based on the future without action <u>and</u> the net addition or loss of facilities provided by the alternatives. In the alternative columns record only those activities on which the project would make a major impact.

Estimates of the demand for visitor days per year are generally based on local surveys. These surveys are based on population in the local area of influence, participation rates (see TSC Technical Notes, BOR Surveys, etc.), or the utilization of existing facilities on heavy-use days. Often estimates of supply (availability) and demand (use) can be obtained from reports already prepared, e.g., North Atlantic regional water resource studies, river basin studies, Appalachia reports, state comprehensive outdoor recreation plans, etc. Future demand can also be based on the estimated future population times participation rates.

Generally, future participation rates are expected to be higher than present because of increased leisure time, greater mobility, improved facilities, and higher income. Record supply and demand for all activities in the "Present" and "Future without action" columns. In the alternative columns, record the supply and demand for only those activities on which the project would make a major impact. Obtain totals of the supply columns and demand columns for all activities in the "Present" and "Future without action" columns.

To determine the effect of the project alternatives, total the entries in the supply columns and demand columns for activities where there is a major impact created by the alternative.

The opportunity index for the activities to be influenced by the project is obtained by dividing the subtotal for supply column by the subtotal for demand column and multiplying by 100.

Quality and uniqueness of the activity must also be considered along with the quantity even though such an evaluation is often subjective. If desired, supply and demand can be converted to dollar evaluations for later use in the economic analysis.

RESOURCE USE
for

Recreation

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Population in local area of influence (LAI)	no.					
Recreation land						
Quantity in LAI[1/]	acres					
Quantity in 1,000 pop in LAI	acres					
Quantity in watershed	acres					
Quality in watershed						
Adequate[2/]	acres					
Not adequate	acres					
Proximity	rating[3/]					
Access	rating					
Hunting land	acres					
Recreation facilities and development	rating					
Recreation water						
Quantity in LAI	acres					
Quantity per 1,000 pop. in LAI	acres					
Quantity in watershed	acres					
Quality in watershed	rating					
Fishing water, stream	miles					
Fishing water, lakes	acres					

1/ LAI, local area of influence, generally a 2-hour drive.

2/ Land is developed to include design that overcomes the soil limitations.

3/ Rating scale: 1, unsuited; 2, poor; 3, neutral or fair; 4, good; 5, excellent.

RESOURCE USE
for

Recreation (con.)

Description of area: ____

Parameters	Unit	Present conditions [1/]	Future conditions [2/] Planning alternatives Without project	With project 1	2	3
Ratio of supply to demand in local area of influence						
Camping	visits per year					
Supply						
Demand						
Picnicking	visits per year					
Supply						
Demand						
Swimming	visits per year					
Supply						
Demand						
Boating	visits per year					
Supply						
Demand						
Fishing	visits per year					
Supply						
Demand						
Hunting	visits per year					
Supply						
Demand						
(other)	visits per year					
Supply						
Demand						
Total	visits per year					
Supply						
Demand						

1/ Record supply and demand for all major activities in the local area of influence (LAI).

2/ Record supply and demand for all major activities influenced by the project alternatives.

RESOURCE USE
for

Recreation (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Total opportunity 3/	visits per year					
Supply						
Demand						
Opportunity index 4/	percent					
Summary	rating					

3/ Total opportunity: the supply and demand of all major activities influenced by the project alternatives.

4/ Opportunity index: total supply divided by total demand times 100.

Wildlife habitat

The wildlife habitat evaluation is based on the quantity, quality, and degree of interspersion of each kind of wildlife habitat in the area under consideration. Most wildlife habitat is created, improved, or maintained by planting vegetation, manipulating existing vegetation, inducing natural establishment of plants, or by combination of such actions; thus, wildlife use and land use go hand-in-hand.

The measurable factors are the vegetative types and conditions according to the various land uses as related to wildlife needs. All significant wildlife species in the project area, both game and nongame, should be considered.

The initial unit of measure is actual acres. The value unit is a quality-size relationship. It is determined by analyzing the habitat condition present or expected on the land.

Wildlife habitat can be grouped into three basic categories for purposes of this assessment procedure: openland habitat, woodland habitat, and wetland habitat. Wetland areas can be recorded by type.

Each habitat model should contain at least three major components:

1. The percentage occurrence component, which is a percentage relationship of habitat elements to one another on a given area.
2. The mangement condition, which is an expression of vegetative quality.
3. The interspersion factor, which considers distribution of vegetation.

In the model each component is assigned a point value expressed in tenths (0-1.0) and used to determine an acre value. These values are not intended to portray all the factors influencing the populations of wildlife on a given area. But, it is assumed that other factors will remain constant or at least not be affected by the activities. For this reason models will vary for each land resource area. It is necessary to make assessments for each major woodland type and possibly for each primary agricultural area within the area being appraised. Assessments should also be made for the site of each proposed structure.

Land use figures can be obtained from the land quantity assessment sheets, crop and pasture management data from cropland and pastureland assessment field notes, and forest types, amounts, and management data from the woodland production field notes.

In most places, it is necessary to make an evaluation for (1) structural works of improvement and for (2) land use and treatment since it is important to separate direct and indirect effects. The effects of the structural works are more direct and immediate; the effects of land use and treatment are based more on land use changes and conservation practices expected or predicted over the life of the project.

The total acreage of the area being evaluated and the total acreage of each structure site are assessed an acre-value for open land habitat and woodland habitat. Thus, there may be 50,000 acres in the area and this acreage may have a 10,000 acre-value as woodland wildlife habitat and a 45,000 acre-value asopen land wildlife habitat.

Determine and record key open land and woodland wildlife species. Note threatened or endangered species on the assessment sheets for open land, woodland, or wetland habitat, both by entire area and site locations.

For each alternative, predict future conditions by using projected land use and management figures.

RESOURCE USE
for

Wildlife habitat

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Site location (impoundments, channels, etc.)						
Open land	ac/ac-value					
Major species	numbers					
Threatened or endangered species	list					
Woodland (by type)	ac/ac-value					
Major species	numbers					
Threatened or endangered species	list					
Wetland (by type)	ac/ac-value					
Major species	numbers					
Threatened or endangered species	list					
Total area (land use and treatment)						
Open land	ac/ac-value					
Major species	numbers					
Threatened or endangered species	list					
Woodland (by type)	ac/ac value					
Major species	numbers					
Threatened or endangered species	list					
Wetland (by type)	acres					
Major species	numbers					
Threatened or endangered species	list					
Summary rating						

Woodland production

Forests used primarily for wood production are rated in terms of expected/potential average annual growth or average yield of wood. Expected means the amount of production that is estimated to exist or will exist under future without action and under the alternatives presented. Potential means the average amount of growth or production that is possible with fully stocked stands for the age classes that exist. The standard unit of measure used for wood production is cubic feet, but it may be desirable in some study areas to use other units of measure or to refine the factors used.

Environmental forest,[2/] Christmas tree areas, and specialty forests are rated in terms of acre equivalent acres/total acres. To determine equivalent acres, convert total acres in production to full production acres for the type of forest or use.

[2/] Environmental forests are those forests known to be devoted to uses that totally exclude them from production of wood products. Examples might be residential areas, parks, or recreation areas, etc.

RESOURCE USE
for

Woodland Production

Description of area: ____________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Wood production forest						
Wood products	ft^3 or					
Expected	bd ft					
Potential						
Forage production	aum					
Expected						
Potential						
Environmental forests 1/	acres					
Christmas tree areas 1/	acres					
Specialty crop forests 1/	acres					
Summary rating						

1/ Acre equivalent over acres.

Economic

Economic analyses are provided in accordance with the SCS Economics Guide and SCS policy. Economic considerations are important in identifying problems and alternatives. Economic impacts should be viewed from both a national and regional viewpoint. National economic development effects are commonly referred to as primary benefits, i.e., flood damage reduction, recreation, fish and wildlife habitat, irrigation, drainage, municipal and industrial water supply, and water quality. Regional external economies are not included as national economic effects. Costs of resource use are external or induced costs and should be included in total installation costs.

Regional effects are gains or losses in regional income and employment. Regional income includes benefits accruing to residents of the region, economies external to the region, and increases in regional wages and salaries. Measurements of external economies utilize input-output (I-O) regional studies. Employment data are presented in terms of additional man-years, which include seasonal and year-long employment.

RESOURCE USE
for

Economic (national)

Description of area: ______________________________

____

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
National viewpoint						
Flood damages	avg. annual $					
Flood damage reduction	avg. annual $					
Other benefits	avg. annual $					
Costs	avg. annual $					
Net benefits	avg. annual $					
Regional viewpoint						
Benefits accruing to residents of the region	avg. annual/$					
Regional cost	avg. annual/$					
Net regional benefits	avg. annual/$					
New regional employment	man-years					

Summary rating

Visual quality

Visual resources are made up of topography, diversity of geologic materials, diversity of vegetation texture and density, distribution and visual condition of water in lakes and streams, and compatability of land use, including farms, forests, and urban areas. An area of high visual quality could include all these items. An area of water has been found to be a consistent preference. An area with low visual quality would have predominantly one kind of relief, one kind of geologic material, very little water, and visually incompatible land uses.

Geologic surface material.--Esthetic value is enhanced by the presence of a wide variety of geologic materials. Use should be compatible with geologic materials. Mudflats around a lake are undesirable, but rocky shores are very desirable. A high-quality geologic surface material would be pleasing to view and convenient to use according to the purpose, i.e., a rocky, erosion-free shore or bank on a lake or stream, a sand beach for swimming, good deep soil for farming, etc. A low-quality area would have predominantly the same material regardless of use.

Water-land ratio.--Visual quality is assumed to be high if about 10 percent of a large area is covered with well-distributed water bodies or stream corridors, average if 3 to 5 percent covered, and low if 2 percent or less is covered.

For high visual quality, the water must be visible from several places, have an irregular shoreline, and contrast with the surrounding land. Streams should have some flow most of the season for a high-quality rating.

Sound.--This item refers to sounds caused directly by improvements such as a pumping plant or indirectly, e.g., by automobiles or motorboats. A noisy diesel pumping plant in a residential area might be unsuitable and rate 1 on a numerical scale of 1 to 5, but an electric plant might be less objectionable and rate 2 or 3. The ideal would be a very low noise level, 5.

Odor.--Waste disposal systems and sewage lagoons may be unsuitable, rating 1, if they create disagreeable odors near a residential area or recreation area but may be tolerated, rating 2 or 3 on a numerical scale of 1 to 5, if in a relatively unused area such as a forest or farm. Here again, the ideal would be the absence of objectionable odors, rating 5.

Visibility.--This item refers to particles in the air that hamper visibility. Probably the greatest threat in SCS projects comes from blowing dust. The presence of blowing dust in quantities substantial enough to reduce visibility is not acceptable. A slight hazard would be fair or neutral and rate 3, and the absence of the threat would be excellent or 5.

Linear structures.--Linear structures may enhance or detract from the visual quality of the landscape. A linear structure in an area of topographic diversity may enhance the visual quality by interrupting the pattern. Conversely, a linear structure located in a flat landscape may detract by visually changing the horizon line or by blocking views of distant mountains or coastlines. The impact of the linear structure on the landscape can be lessened if the structure is made from materials that "fit" with the surroundings and provide a welcome break in the pattern.

Dams.--Dams constructed with SCS assistance are generally made of earth. They have a mechanical principal spillway and usually an earth emergency spillway. Dams add water and open space, thus expanding the view, which is generally an improvement. Dams may add or detract from the visual quality of the landscape. The rating depends on how well the dam and pool fit into the landscape. The scars caused by borrow pits and emergency spillways may have a negative effect on the visual quality of the dam and, if substantial, reduce the rating by one point.

Recreation facilities.--These include shelter houses, restrooms, swimming beaches, boat docks, and parking lots. Such facilities generally are accepted as a part of the total project and may either add or detract from the visual quality of the area. Facilities on the shoreline may disrupt the continuity of the view and detract from the visual quality unless properly located and designed to fit in the landscape. Normally, recreation facilities are rated 2, 3, or 4 unless there is a very outstanding feature present in the development.

Other structures.--Buildings, pumping plants, sewage treatment plants, and other structures associated with SCS projects are usually relatively small and, if well planned, neither add nor detract from the visual quality of the area. They may detract if located close to a residential or recreation area and do not "fit" well with their surroundings. Normal rating would be 2 or 3 on a numerical scale of 1 to 5; 1, unsuited; 2, poor; 3, neutral; 4, good; and 5, excellent.

RESOURCE USE
for

Visual quality of the landscape

Description of area: ____

____

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Land						
Visual quality of land	rating					
Geologic surface material	rating					
Water						
Water-land ratio	rating					
Visual quality of water body or stream	rating					
Air						
Sound	rating					
Odor	rating					
Visibility	rating					
Manmade objects						
Linear structures (dikes, spoils, channels)	rating					
Dams	rating					
Recreation facilities (shelter houses, rest-rooms, swimming beaches, boat docks, etc.)	rating					
Other structures (buildings, pumping plants, sewage treatment plants, etc.)	rating					
Summary rating						

Social

Program activities of SCS have a significant impact on the social well-being of the nation's citizenry. This impact needs to be measured during planning and taken into account in decisionmaking and in preparing environmental impact statements. Factors that may be pertinent include population (total density and stratification), health factors (adequacy of domestic water supply, sewage disposal, doctors, dentists, hospitals, residences for the aged), housing (total, adequacy), and education (pupil/classroom ratio). Data from secondary sources are usually obtained for social evaluations. An excellent source of information about social assessment is, "A Guide to the Preparation of the Social Well-being Account, Social Assessment Manual," by Stephen Fitzsimmons, Lorrie Stuart, and Peter Wolff, July 1975.

RESOURCE USE
for

Social

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	2	3
Total population	no.					
Population density	no./mi^2					
Age						
Under 5	pct					
5-14	pct					
15-44	pct					
45-64	pct					
64 and over	pct					
Water supply						
Individual systems	no.					
Community	gal/capita/day					
Sewage disposal						
Individual systems served by public system	no. of pop.					
Health						
Doctors per 1,000 pop.	no.					
Dentists per 1,000 pop.	no.					
Hospitals (beds per 1,000 pop.)	no.					
Residence for aged (beds per 1,000 pop.)	no.					
Vector control	acres					
Housing						
Total	no.					
Adequacy (safe, sanitary, decent)	pct					
Person per household	no.					

RESOURCE USE
for

Social (con.)

Description of area: ______________________________

Parameters	Unit	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Education						
Pupils per classroom	no.					
Pupil teacher	ratio					
Median school completed	yr					
Outmigration	no/year					
Median family income	$/yr					
Below poverty level of ______/year	pct					
Income distribution						
Less than $3,000	pct					
$3,000 to 10,000	pct					
Greater than $10,000	pct					
Safety of life						
Level of flood protection to populated areas	freq.					
Summary rating						

Unique cultural, historical, archeological, architectural, and natural resources

Factors for this activity include landmarks and cultural resources.

Landmarks.--Landmarks are generally made up of components of the natural system that have some prehistorical, historical, or other unique characteristic.

Cultural resources.--Factors (impacts) are related to man's influence and include such things as prehistorical, historical, and present cultural groups, migration, patterns of living, etc. Develop factors as necessary to display these resources and resource uses.

Threatened species.--List name of animal species and approximate population in impact zone. List name of plant species and acres present in affected area. Note whether the designation is by state or federal listing.

RESOURCE USE
for

Unique, Cultural, Historical, and Natural

Description of area: ______________________________

			Future conditions			
			Planning alternatives			
		Present	Without	With project		
Parameters	Unit	conditions	project	1	2	3
Use density	no. of people/mi^2					
Landmarks						
Historical sites and monuments	no.					
Unique natural geologic areas	no.					
Archeological sites	no.					
Architectural sites	no.					
Scientific sites	no.					
Cultural resources						
Population migration	pct					
Ethnic groups	no.					
Seasonal homes	no.					
Threatened or endangered species						
Animals	no.					
Plants	acres					
Summary rating						

Summarizing checklist assessment data for decision makers

Checklist assessment findings may be reflected in a variety of ways in program planning documents. A short executive summary of the assessment and a map of the project area are usually needed. Such narrative summaries will usually be prepared by the interdisciplinary team and highlight significant impacts and include recommendations about specific alternatives. Overview summaries containing brief summaries of the ratings by the interdisciplinary team may also be useful. A general format for this section is shown on the opposite page.

More detailed technical summaries may also be needed to support planning documents. The second section may contain quantity and quality rating sheets for those resources that are likely to be affected by the proposed action and rating sheets for each resource use.

SUMMARY RATINGS

Description of area: ______________________________

____

Basic resources and resource uses	Present conditions	Future conditions: Planning alternatives: Without project	With project 1	With project 2	With project 3
Land quantity					
Land quality					
Water quantity					
Water quality					
Air quality					
Cropland production					
Fish habitat					
Industrial water supply					
Irrigation water					
Low flow					
Mineral production					
Municipal water supply					
Pastureland production					
Rangeland production					
Recreation					
Wildlife habitat					
Woodland production					
Economic national					
Economic regional					
Visual quality of landscape					
Social					
Unique, cultural, historical, and natural					